

CLAIMS

What is Claimed is:

1. A minimum signature solid propellant formulation comprising:
 - about 6.0 to about 9.0 weight % of at least one polymeric binder;
 - about 21 to about 25 weight % of at least one energetic plasticizer; and
 - about 55 to about 65 weight % of neat ammonium dinitramide having a particle size of about 20 μm to about 60 μm as a neat ADN oxidizer.
2. The solid propellant formulation of Claim 1, wherein said binder is selected from the group consisting of polycaprolactone, poly(diethyleneglycol-4,8-dinitraza undeconate) and polyglycidal nitrate.
3. The solid propellant formulation of Claim 1, wherein said plasticizer is selected from the group consisting of butanetriol trinitrate, trimethylolethane trinitrate, n-n-butyl-N-(2-nitroxyethyl)nitramine and any combination thereof.
4. The solid propellant formulation of Claims 1, further comprising at least one member selected from a curative, a stabilizer, a cure catalyst, crosslinker, a burn rate modifier and a bonding agent.
5. The solid propellant formulation of Claim 4, wherein said curative is selected from the group consisting of hexamethylene diisocyanate, m-tetramethylxylene diisocyanate, dimeryl diisocyanate, toluene diisocyanate, polymeric hexamethylene diisocyanate, isophorone diisocyanate, biuret triisocyanate and any combination thereof.
6. The solid propellant formulation of Claim 4, wherein said cure catalyst is selected from the group consisting of triphenyl bismuth triphenyltin chloride, dibutyltin

diacetate and dibutyltin dilaurate.

7. The solid propellant formulation of Claim 4, wherein said stabilizer is selected from the group consisting of N-methyl-p-nitroaniline and 2-NDPA (2-nitrodiphenylamine).

5 8. The solid propellant formulation of Claim 4, wherein said burn rate modifier is carbon black.

9. The solid propellant formulation of Claim 4, wherein said crosslinker is nitrocellulose.

10 10. The solid propellant formulation of Claim 1, wherein said solid propellant further comprises at one member selected from ammonium dinitramide prills and CL-20.

11. A minimum signature solid propellant formulation comprising:

about 6.0 to about 9.0 weight % of at least one polymeric binder;

about 21 to about 28 weight % of at least one energetic plasticizer;

about 17 to about 25 weight % of neat ammonium dinitramide having a
15 particle size of about 20 μm to about 60 μm as a neat ADN oxidizer;

and

about 35 to about 45 weight % of ammonium dinitramide prills having a
particle size of about 100 μm to about 200 μm as an ADN prills
oxidizer.

20 12. The solid propellant formulation of Claim 11, wherein said binder is selected from the group consisting of polycaprolactone and poly(diethyleneglycol-4,8-dinitraza undeconate).

13. The solid propellant formulation of Claim 11, wherein said plasticizer is selected

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- from the group consisting of butanetriol trinitrate, trimethylolethane trinitrate, n-n-butyl-N-(2-nitoxyethyl)nitramine and any combination thereof.
14. The solid propellant formulation of Claims 11, further comprising at least one member selected from a curative, a stabilizer, a cure catalyst, a crosslinker, a burn rate modifier and a bonding agent.
15. The solid propellant formulation of Claim 14, wherein said curative is selected from the group consisting of hexamethylene diisocyanate, m-tetramethylxylene diisocyanate, dimeryl diisocyanate, toluene diisocyanate, polymeric hexamethylene diisocyanate, isophorone diisocyanate, biuret triisocyanate and any combination thereof.
16. The solid propellant formulation of Claim 14, wherein said cure catalyst is selected from the group consisting of triphenyl bismuth triphenyltin chloride, dibutyltin diacetate and dibutyltin dilaurate.
17. The solid propellant formulation of Claim 14, wherein said stabilizer is selected from the group consisting of N-methyl-p-nitroaniline and 2-NDPA (2-nitrodiphenylamine).
18. The solid propellant formulation of Claim 14, wherein said burn rate modifier is carbon black.
19. The solid propellant formulation of Claim 14, wherein said crosslinker is nitrocellulose.
20. The solid propellant formulation of Claim 11, wherein said solid propellant further comprises CL-20.
21. A minimum signature solid propellant formulation comprising:

about 6.0 to about 9.0 weight % of at least one polymeric binder;
about 21 to about 25 weight % of at least one energetic plasticizer;
about 25 to about 45 weight % of ammonium dinitramide prills having a
particle size of about 100 μm to about 200 μm as an ADN prills
oxidizer; and
about 15 to about 25 weight % of CL-20.

22. The solid propellant formulation of Claim 21, wherein said CL-20 has a particle size of about 3 μm .
23. The solid propellant formulation of Claim 21, wherein said binder is selected from the group consisting of polycaprolactone, poly(diethyleneglycol-4,8-dinitraza undecanate) and polyglycidal nitrate.
24. The solid propellant formulation of Claim 21, wherein said plasticizer is selected from the group consisting of butanetriol trinitrate, trimethylolethane trinitrate, n-butyl-N-(2-nitroxyethyl)nitramine and any combination thereof.
25. The solid propellant formulation of Claims 21, further comprising at least one member selected from a curative, a stabilizer, a cure catalyst, crosslinker, a burn rate modifier and a bonding agent.
26. The solid propellant formulation of Claim 25, wherein said curative is selected from the group consisting of hexamethylene diisocyanate, m-tetramethylxylene diisocyanate, dimeryl diisocyanate, toluene diisocyanate, polymeric hexamethylene diisocyanate, isophorone diisocyanate, biuret triisocyanate and any combination thereof.
27. The solid propellant formulation of Claim 25, wherein said cure catalyst is

selected from the group consisting of triphenyl bismuth triphenyltin chloride, dibutyltin diacetate and dibutyltin dilaurate.

28. The solid propellant formulation of Claim 25, wherein said stabilizer is selected from the group consisting of N-methyl-p-nitroaniline and 2-NDPA (2-nitrodiphenylamine).

29. The solid propellant formulation of Claim 25, wherein said burn rate modifier is carbon black.

30. The solid propellant formulation of Claim 25, wherein said crosslinker is nitrocellulose.

31. A minimum signature solid propellant formulation comprising:

about 6.0 to about 9.2 weight % of at least one polymeric binder;
about 21 to about 28 weight % of at least one energetic plasticizer; and
about 55 to about 68 weight % of neat ammonium dinitramide having a particle size of about 20 μm to about 60 μm as a neat ADN oxidizer.

32. The solid propellant formulation of Claim 31, wherein said polymeric binder is polycaprolactone.

33. The solid propellant formulation of Claim 31, wherein said energetic plasticizer comprises:

about 4.0 to about 6.0 weight % of butanetriol trinitrate;
about 7.0 to about 9.0 weight % of trimethylolethane trinitrate; and
about 10.0 to about 13.0 weight % of n-n-butyl-N-(2-nitoxyethyl)nitramine.

34. The solid propellant formulation of Claim 31, further comprising at least one

member selected from a curative, a stabilizer, a cure catalyst, crosslinker, a burn rate modifier and a bonding agent.

35. A minimum signature solid propellant formulation comprising:

about 6.0 to about 9.2 weight % of at least one polymeric binder;

5 about 21 to about 28 weight % of at least one energetic plasticizer;

about 17 to about 25 weight % of neat ammonium dinitramide having a
particle size of about 20 μm to about 60 μm as a neat ADN oxidizer;

and

about 35 to about 45 weight % of ammonium dinitramide prills having a
10 particle size of about 100 μm to about 200 μm as an ADN prills
oxidizer.

36. The solid propellant formulation of Claim 35, wherein said polymeric binder is polycaprolactone.

37. The solid propellant formulation of Claim 35, wherein said energetic plasticizer
15 comprises:

about 4.0 to about 6.0 weight % of butanetriol trinitrate;

about 7.0 to about 9.0 weight % of trimethylolethane trinitrate; and

about 10.0 to about 13.0 weight % of n-n-butyl-N-(2-
nitoxyethyl)nitramine.

20 38. The solid propellant formulation of Claim 35, further comprising at least one
member selected from a curative, a stabilizer, a cure catalyst, crosslinker, a burn
rate modifier and a bonding agent.

39. A minimum signature solid propellant formulation comprising:

about 6.0 to about 9.2 weight % of at least one polymeric binder;
about 21 to about 28 weight % of at least one energetic plasticizer;
about 35 to about 45 weight % of ammonium dinitramide prills having a
particle size of about 100 μm to about 200 μm as an ADN prills
oxidizer; and
about 15 to about 25 weight % of CL-20.

40. The solid propellant formulation of Claim 39, wherein said polymeric binder is polycaprolactone.

41. The solid propellant formulation of Claim 39, wherein said energetic plasticizer comprises:

about 4.0 to about 6.0 weight % of butanetriol trinitrate;
about 7.0 to about 9.0 weight % of trimethylolethane trinitrate; and
about 10.0 to about 13.0 weight % of n-n-butyl-N-(2-nitoxyethyl)nitramine.

42. The solid propellant formulation of Claim 39, further comprising at least one member selected from a curative, a stabilizer, a cure catalyst, crosslinker, a burn rate modifier and a bonding agent.

43. A minimum signature solid propellant formulation comprising:

about 6.0 to about 9.0 weight % of at least one polymeric binder;
about 20 to about 34 weight % of at least one energetic plasticizer; and
about 50 to about 65 weight % of neat ammonium dinitramide having a
particle size of about 20 μm to about 60 μm as a neat ADN oxidizer.

44. The solid propellant formulation of Claim 43, wherein said polymeric binder is

poly(diethyleneglycol-4,8-dinitraza undeconate).

45. The solid propellant formulation of Claim 43, wherein said energetic plasticizer comprises:

about 5.0 to about 12.0 weight % of butanetriol trinitrate; and

5 about 15.0 to about 22.0 weight % of trimethylolethane trinitrate.

46. The solid propellant formulation of Claim 43, further comprising at least one member selected from a curative, a stabilizer, a cure catalyst, crosslinker, a burn rate modifier and a bonding agent.

47. A minimum signature solid propellant formulation comprising:

10 about 6.0 to about 9.0 weight % of at least one polymeric binder;

about 20 to about 34 weight % of at least one energetic plasticizer;

about 17 to about 25 weight % of neat ammonium dinitramide having a
particle size of about 20 μm to about 60 μm as a neat ADN oxidizer;

and

15 about 35 to about 45 weight % of ammonium dinitramide prills having a
particle size of about 100 μm to about 200 μm as an ADN prills
oxidizer.

48. The solid propellant formulation of Claim 47, wherein said polymeric binder is poly(diethyleneglycol-4,8-dinitraza undeconate).

- 20 49. The solid propellant formulation of Claim 47, wherein said energetic plasticizer comprises:

about 5.0 to about 12.0 weight % of butanetriol trinitrate; and

about 15.0 to about 22.0 weight % of trimethylolethane trinitrate.

50. The solid propellant formulation of Claim 47, further comprising at least one member selected from a curative, a stabilizer, a cure catalyst, crosslinker, a burn rate modifier and a bonding agent.

51. A minimum signature solid propellant formulation comprising:

- 5 about 6.0 to about 9.0 weight % of at least one polymeric binder;
 about 20 to about 34 weight % of at least one energetic plasticizer;
 about 25 to about 45 weight % of ammonium dinitramide prills having a
 particle size of about 100 μm to about 200 μm as an ADN prills
 oxidizer; and
10 about 15 to about 25 weight % of CL-20.

52. The solid propellant formulation of Claim 51, wherein said polymeric binder is poly(diethyleneglycol-4,8-dinitraza undeconate).

53. The solid propellant formulation of Claim 51, wherein said energetic plasticizer comprises:

- 15 about 5.0 to about 12.0 weight % of butanetriol trinitrate; and
 about 15.0 to about 22.0 weight % of trimethylolethane trinitrate.

54. The solid propellant formulation of Claim 51, further comprising at least one member selected from a curative, a stabilizer, a cure catalyst, crosslinker, a burn rate modifier and a bonding agent.

20 55. A minimum signature solid propellant formulation comprising:

- about 6.0 to about 10.5 weight % of at least one polymeric binder;
 about 12 to about 32 weight % of at least one energetic plasticizer; and
 about 50 to about 65 weight % of neat ammonium dinitramide having a

particle size of about 20 μm to about 60 μm as a neat ADN oxidizer;

56. The solid propellant formulation of Claim 55, wherein said polymeric binder is polyglycidal nitrate.

57. The solid propellant formulation of Claim 55, wherein said energetic plasticizer
5 comprises:

about 0 to about 7.0 weight % of said butanetriol trinitrate;

about 10.0 to about 15.0 weight % of said trimethylolethane trinitrate; and

about 2.0 to about 10.0 weight % of said n-n-butyl-N-(2-nitoxylethyl)nitramine.

58. The solid propellant formulation of Claim 55, further comprising at least one
10 member selected from a curative, a stabilizer, a cure catalyst, a burn rate catalyst and a bonding agent.

59. A minimum signature solid propellant formulation comprising:

about 6.0 to about 10.5 weight % of at least one polymeric binder;

15 about 12 to about 32 weight % of at least one energetic plasticizer;

about 25 to about 45 weight % of ammonium dinitramide prills having a
particle size of about 100 μm to about 200 μm as an ADN prills

oxidizer; and

about 15 to about 25 weight % of CL-20.

60. The solid propellant formulation of Claim 59, wherein said polymeric binder is
20 polyglycidal nitrate.

61. The solid propellant formulation of Claim 59, wherein said energetic plasticizer
comprises:

about 0 to about 7.0 weight % of said butanetriol trinitrate;

about 10.0 to about 15.0 weight % of said trimethylolethane trinitrate; and

about 2.0 to about 10.0 weight % of said n-n-butyl-N-(2-

nitroxyethyl)nitramine.

- 5 62. The solid propellant formulation of Claim 59, further comprising at least one member selected from a curative, a stabilizer, a cure catalyst, a burn rate catalyst and a bonding agent.

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